recommends the use of the 'Normal Pyrometric Cones,' invented by Dr. Seger, as affording a safe and simple method of controlling the temperature of the kiln. He considers it quite possible to prepare cones from our domestic materials, fully as reliable as those now made in Germany.

In Chapter V. that subject often so troublesome to pottery makers—Glazes, their requirements and composition—is presented. The various kinds of Ware, Bricks and Terra Cotta comprise the succeeding chapters up to the fourteenth, on Refractory Materials, in which the preparation of fire clays for use in kiln building and for "saggars," is fully explained. Sixteen pages on Burning the Ware, in which the requisites of this important part of pottery making are interestingly detailed, form the final chapter. A convenient index follows.

A few more illustrations or diagrams in the body of the work would have given it added interest for the majority of chemists who have only a superficial knowledge of the processes of pottery making. FRANK H. THORP.

SCIENTIFIC JOURNALS.

JOURNAL OF GEOLOGY, FEBRUARY–MARCH.

Kame Areas in Western New York South of Irondequoit and Sodus Bays: By H. L. FAIRCHILD. The purpose of the paper is to describe certain massive deposits of sand and gravel apparently formed by the glacial drainage. These bays are the extreme points in the great landward curve in the south shore of Lake Ontario, and are thought to have greatly influenced the drainage of the region during the recession of the ice. Four Kame areas are described—Irondequoit, Victor, Mendon and Junius. The author finds these areas alike in the following particulars: (a) they are located in the basin of Lake Warren; (b) they have an overwash or silt plain to the southward; (c) they lie in the midst of drumloid ridges which antedate the kame deposits; (d) only one has any clear connection with an extended frontal moraine. He thinks the causation is complex, including rapid ice retreat, action of lake waters to prevent great local accumulations of morainic till and heavy glacial drainage.

A Pre-Tertiary Nepheline-Bearing Rock: By F. BASCOM. The rock in question is a glacial boulder found in the vicinity of Columbus, Ohio. There was a single specimen about a foot and one-half in diameter, but it is of a type so rare as to justify in the mind of the author a particular mention. She inclines to the opinion that it belongs to the nepheline syenite porphyry group. The source is not known, but is presumed to be the area north of Lake Huron, and if so the boulder is from a Cambrian horizon or lower. In any case it is a pre-Tertiary dike or surface volcanic resembling the modern type.

Remarks on Petalodus Alleghaniensis (Leidy): By CHAS. R. EASTMAN. In a previous issue of the journal Dr. Hay described a specimen of Selachian tooth from the Carboniferous of Illinois. For the form he proposed the name Petalodus Securiger. In the present paper the author dissents from this view and gives reasons why the new name should not be accepted. His opinion is that the form belongs to P. Alleghaniensis.

Patalocrinus Mirabilis (N. sp.) *and a New American Fauna:* By S. WELLER and MRS. A. D. DAVIDSON. The fossils here described were collected by the junior author in Jones county, Iowa. Goniophyllum pyramidale and the species of Crotalocrinus have long been known in the Gothland limestone of Sweden. In this Iowa Silurian fauna, species of Goniophyllum are found indistinguishable from those of Gothland, with a crinoid whose nearest ally is Crotalocrinus. The crinoid, which is a new one, is carefully described and figured by the senior author, who finds an explanation of the similarity between the Gothland and Iowa faunas in a migration along a supposed shore line, joining the east American and British regions during Niagara time.

On the Nature of Igneous Intrusions: By ISRAEL C. RUSSELL. In a previous paper the author described some hills in the Black Hills region, which illustrated a little known phase of igneous intrusion. He now discusses igneous intrusion in the light of his large experience in many localities. Of these he finds several classes—intruded sheets like those of the Newark which, when widely extended are of easily fusible rock and relatively surperficial, lacco-

lites like the well-known Henry mountains, plutonic plugs of which there are several examples in the vicinity of the Black Hills, and deeply-seated intrusions of a viscous magma which raised vast domes of sedimentary rock with the floor of metamorphic rock on which they rested as the whole Black Hills dome, Big Horn and Park mountains. As to the cause of these uplifts, nothing less than the force exerted by a cooling globe is thought to be adequate. That they took place very slowly is inferred from the fact that fracture did not result from the bending of thousands of feet of strata. That these domes are in the interior of the continent rather than near the coast is because here the crust is relatively light and strata are horizontal, hence pressure on the plastic interior due to contraction of crust or to transfer of material on the surface would be most likely to produce domes.

Deformation of Rocks: By C. R. VAN HISE. This is the first of a series of papers on the same subject to be published in the *Journal* as 'Studies for Students.' The author divides the outer part of the earth into three zones: (1) An upper zone of fracture; (2) a middle zone of fracture and plasticity; (3) a lower zone of plasticity. Rocks under less weight than their ultimate strength when rapidly deformed are in the zone of fracture. The maximum depth at which fracture can take place is thought to be 10,000 meters. Rocks below this are in the region of plasticity and flowage. Since flowage is necessary to folding, closely folded strata were generally buried beneath other strata. The boundary between the zone of fracture and that of flowage is at different depths for two rocks of different strength, also for the same rock under different conditions of stress, hence there is a zone of combined fracture and flowage. This is thick and of prime importance. In heterogeneous strata in this zone, irregular fracturing, brecciation, jointing, faulting, folding, and development of secondary structures, may occur together in a most complex manner. Between the three zones there are many gradations.

Chas. R. Keyes contributes a careful and appreciative review of Wachsmuth and Springer's new book, *North American Fossil Crinoidea Camerata*. Several reviews and authors' abstracts of current geological literature follow.

SOCIETIES AND ACADEMIES.

GEOLOGICAL CONFERENCE OF HARVARD UNIVERSITY, MARCH 10, 1896.

An elementary presentation of the tides: BY W. M. DAVIS.

The object of this communication is to show how the tides may be treated in an essentially scientific manner in an elementary collegiate course on physiography. The facts are presented by means of tracings from selected automatic records of tide gauges in the Coast Survey office, for stations in mid-ocean (Honolulu), Pacific coast (Port Townsend, Wash.), Atlantic coast (Boston), and in estuaries (Delaware at Philadelphia, and lower Seine, the latter from French records). Mean interval of tides, and systematic variation of interval and of range are numerically determined from these records by the students in laboratory exercises. The agreement of the mean interval with half a lunar day suggests that the moon and the tides may be related in some way as cause and effect. Inquiry is then made as to the manner in which the moon could cause periodic oscillations of the ocean.

The dimensions, distance and movements of the earth and moon being given, the deforming forces due to lunar attraction, situated as it were on a shell enclosing the earth, are worked out quantitatively in terms of gravity, according to the law of gravitation. A tide opposite to the direct lunar tide, often regarded as an obscure part of the problem, is seen to be as essential a consequence of the theory as the direct tide itself. The first simple supposition of a moon moving in a circular orbit in the plane of the earth's equator is afterwards changed to the actual condition of the moon moving in an orbit of considerable eccentricity and in a plane oblique to the equator; thus introducing expectations of various systematic inequalities in tidal intervals and ranges. The essential features of diurnal inequality are simply illustrated as a necessary consequence of theory by means of a 'tidal globe,' rigged with appropriate circles for high and low tides. Solar tidal forces and